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*Incorporating
Corrigenda
February 2001
and March 2002*

Pumps and pump units for liquids — Common safety requirements

ICS 23.080

National foreword

This British Standard is the UK implementation of EN 809:1998+A1:2009, incorporating corrigenda February 2001 and March 2002. It supersedes BS EN 809:1998 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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 NORME EUROPÉENNE
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English Version

**Pumps and pump units for liquids - Common safety
 requirements**

Pompes et groupes motopompes pour liquides -
 Prescriptions communes de sécurité

Pumpen und Pumpenaggregate für Flüssigkeiten -
 Allgemeine sicherheitstechnische Anforderungen

This European Standard was approved by CEN on 7 November 1997 and includes Corrigendum 1 issued by CEN on 20 March 2002 and Amendment 1 approved by CEN on 20 August 2009.

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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 809:1998+A1:2009) has been prepared by Technical Committee CEN/TC 197 "Pumps", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2010, and conflicting national standards shall be withdrawn at the latest by April 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2009-08-20 and Corrigendum 1, issued by CEN on 2001-02-14.

This document supersedes EN 809:1998.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags **AC** **AC**.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

A1 For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. **A1**

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This Standard has been prepared to be a harmonized standard to provide one means of conformity with the Essential requirements of the Machinery Directive and associated EFTA Regulations.

A1 This European Standard is a type C standard as stated in EN ISO 12100-1.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards for machines that have been designed and built according to the provisions of this type C standard.

The extent to which hazards are covered is indicated in Clause 4 "List of hazards" of this European Standard. **A1**

1 Scope

A1 This European Standard establishes the technical safety requirements for:

- constructing;
- assembling;
- erecting;
- operating;
- servicing;

a liquid pump or pump unit. It contains a list of significant hazards, which can arise with the use of a liquid pump or pump unit, and establishes the requirements and/or protective measures which will lead to a reduction of the risks.

Liquid pumps covered by this European Standard are:

- rotodynamic pumps;
- rotary positive displacement pumps;
- reciprocating displacement pumps;

supplied separately without drive (electric motor or internal combustion engine).

In general, pumps are defined as being terminated by their inlet and outlet connections as well as by their shaft ends. Pumps supplied in this form are usually called bareshaft pumps. They are 'machines' in the definition of the Machinery Directive.

The assembly of a bareshaft pump with its driver can require measures that are outside the scope of this European Standard.

Pump units are described as: **A1**

A1 Liquid pumps together with a driver and including transmission elements, baseplates, and any auxiliary equipment.

This European Standard does not deal either with the technical safety requirements for the design or manufacture of drivers nor of auxiliary equipment. It does not set down either requirements for the risks directly arising from means provided for the portability, transportability and mobility of pump units during or between periods of their operation, nor the requirements for transmission shafts linking a tractor or other self-propelled machinery to a pump.

This European Standard does not cover pumps and pump units for the following applications:

- pumps and pump units whose only power source is directly applied manual effort;
- pumps and pump units for medical use used in direct contact with the patient;
- pumps and pump units specially designed or put into service for nuclear purposes which, in the event of failure, can result in an emission of radioactivity;
- pumps and pump units for use on seagoing vessels or mobile off-shore units;
- pumps and pump units specially designed for military or police purposes.

Neither does it cover pumps and pump units for hydraulic power transmission.

Specific requirements for particular features of pumps additional to the common requirements set out in this standard can be found in other standards such as EN 1028, EN 1151, EN 1829, and in the European Standards on submersible pump units and for liquid pumps for the use in agrifoodstuff industries.

This European Standard is not applicable to pumps and pump units which are manufactured before the date of publication of this European Standard. A1

2 Normative references

A1 The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 894-1, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays control actuators*

EN 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 1037, *Safety of machinery — Prevention of unexpected start-up*

EN 12162, *Liquid pumps — Safety requirements — Procedure for hydrostatic testing* A1

[A1] EN 12723, *Liquid pumps — General terms for pumps and installations — Definitions, quantities, letter symbols and units*

EN 60034-5:2001, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) — Classification (IEC 60034-5:2000)*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN ISO 5199, *Technical specifications for centrifugal pumps — Class II (ISO 5199:2002)*

EN ISO 9905, *Technical specifications for centrifugal pumps — Class I (ISO 9905:1994)*

EN ISO 9908, *Technical specifications for centrifugal pumps — Class III (ISO 9908:1993)*

EN ISO 12100-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

EN ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by the upper and lower limbs (ISO 13857:2008)*

EN ISO 14121-1, *Safety of machinery — Risk assessment — Part 1: Principles (ISO 14121-1:2007)*

EN ISO 14847, *Rotary positive displacement pumps — General requirements (ISO 14847:1999)*

EN ISO 20361, *Liquid pumps and pump units — Noise test code — Grades 2 and 3 of accuracy (ISO 20361:2007)* [A1]

3 Definitions

For the purposes of this Standard, the definitions contained in [A1] EN 12723 [A1] shall apply.

Further the following definition applies :

3.1

Auxiliary equipment

Components or sub-assemblies mounted as part of the pump unit and necessary for the operation of the pump or pump unit, for example, seal flush system, lubrication system, cooling system, etc..

[A1] 3.2

partly completed machinery/pump

assembly of components which still needs a considerable number of additional components or at least one major component to fulfil its task

NOTE Subassemblies without any hydraulic component is not be classified as partly completed machinery. [A1]

4 List of hazards

A1 The significant hazards are set out in the following listing based on EN ISO 12100-1 and EN ISO 12100-2. Also shown are the sections references in this European Standard in which the safety requirements and/or measures or rules are described for showing the conformity to the safety requirements.

In addition, machinery shall comply as appropriate with EN ISO 12100-1 for hazards which are not covered by this European Standard. **A1**

Table 1 — List of hazards

A1 deleted text A1	Significant hazards	EN 809 Reference to subclause	
		Safety measures	Verification
	Mechanical hazards	5.2.1	6.2.1
	Crushing, cutting and severing, entanglement or enwrapment, drawing in or trapping, friction or abrasion	5.2.1.1	6.2.1 6.2.6
	High pressure fluid ejection	5.2.1.2 5.2.1.2.2	6.2.1 6.2.2 6.2.3 6.2.4
	Ejection of parts	5.2.1.3	6.2.1 6.2.2
	Loss of stability	5.2.1.4	6.2.7
	Electrical hazards	5.2.2	6.2.2
	Electrical contact	5.2.2.1	6.2.2
	Electrostatic phenomenon	5.2.2.2	6.2.1
	External influences on electrical equipment	5.2.2.3	6.2.2
	Thermal hazards	5.2.3	6.2.2 6.2.8
	Hazards generated by noise	5.2.4 5.2.4.1	6.2.2 6.2.5
	Hazards generated by vibrations	5.2.4.2	6.2.2
	Hazards generated by materials	5.2.5	6.2.2
	Contact with or inhalation of harmful fluids, gases, mists, steam	5.2.5.1	6.2.1
	Fire and explosion hazards	5.2.5.3	6.2.1 6.2.2 6.2.8
	Hazards from neglecting ergonomic principles in machine design	5.2.6	6.2.1 6.2.2
	Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders	5.2.7	6.2.1
	Failure, malfunction of control system	5.2.7.2 5.2.7.3 5.2.7.5	6.2.1 6.2.2
	Errors of fitting	5.2.7.1 5.2.7.4 A1 and 7.3 A1	6.2.1
	Hazards caused by missing and/or incorrectly positioned safety related measures/means	5.2.8	6.2.1
	All kinds of guards	5.2.8.1	6.2.1 6.2.6
	All kinds of safety related protection devices	5.2.8.1 5.2.8.5	6.2.1 6.2.6
	All kinds of information or warning devices	5.2.8.2	6.2.1
	Emergency devices	5.2.8.3	6.2.2
	Essential equipment and accessories for safe adjusting and/or maintenance	5.2.8.4	6.2.2
	A1 Resulting from machinery lifting	5.2.1.5 and 7.2.2	6.2.2 and 6.2.3 A1

5 Safety requirements and/or measures

5.1 General requirements

The operating conditions and features required of every pump and/or pump unit falling within the scope of this standard shall be defined in a specification. This may be in the form of a manufacturer's description, or as a published national or international standard or in a data sheet within a contract. In the event of essential data not being provided by the purchaser, the manufacturer shall advise the purchaser of the data being adopted for the design and being incorporated into the specification. The supplier shall assess the risks arising from the machine together with its operating conditions and the equipment shall be designed to reduce them to an acceptable level giving full regard to the requirements set out in this standard. ^{A1} A risk assessment according to EN ISO 14121-1 shall be carried out by the manufacturer. This has to be done for machinery as well as for partly completed machinery to the extent necessary to assess the conformity with the essential health and safety requirements. When assessing the risks arising from the machinery or partly completed machinery, the manufacturer shall take into account any reasonable foreseeable misuse and the lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and disposal. ^{A1}

NOTE The technical specifications will vary with the application, and some technical specifications are already stated in EN or ISO-Standards, such as :

- ^{A1} EN ISO 5199 ;
- EN ISO 14847 ;
- EN ISO 9908 ;
- EN ISO 9905 ^{A1}.

Further safety information from the manufacturer/supplier for :

- planning ;
- installation ;
- operation ;
- maintenance.

shall be contained in the information/instruction for use, including personnel protection equipment required and warning notices.

5.1.1 Environmental and working conditions

In constructing the specification for the pump or pump unit particular attention shall be given to any special environmental and/or working conditions. Examples of such special conditions are, amongst others :

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EN 809:1998+A1:2009 (E)

Environmental Conditions at the place of installation, such as :

- abnormal temperature ;
- high humidity ;
- corrosive atmospheres ;
- explosive and/or fire danger zones ;
- dust, sandstorms ;
- earthquakes and other external imposed such conditions ;
- vibrations ;
- altitude ;
- flooding.

Type of liquid to be pumped, such as :

- pumped liquid (Denomination) ;
- mixture (Analysis) ;
- solid containing (solid matter content) ;
- gaseous (content).

Property of the liquid when being pumped, such as :

- flammable ;
- toxic ;
- corrosive ;
- abrasive ;
- crystallising ;
- polymerizing ;
- viscosity.

Operating fluctuation in the system, such as :

- temperature ;
- pressure ;
- flow rate ;
- dry running of the pump.

5.2 Special requirements

5.2.1 Requirements to avoid mechanical hazards

5.2.1.1 Crushing, cutting and entanglement

Exposed moving parts may create a hazard and means shall be incorporated to reduce the risk. Such means shall include as appropriate :

- barriers conforming to A1 EN ISO 13857 A1 preventing contact with moving parts ;
- gaps at the end-of-travel conforming to EN 349 ;
- guards conforming to EN 953.

Rotating shafts with exposed keys, keyways or other projections liable to cut or catch shall be A1 *deleted text* A1 guarded. Guards or permanent enclosures shall be used for rotating or reciprocating transmission couplings or crossarms.

A1 Guards or casing providing the function of a guard shall be removable only with the use of a tool.

Whenever possible fixed guards or casing providing the function of a fixed guard shall be incapable of remaining in place without their fixings.

The fixing system shall remained attached to the guard (or casing providing the function of the fixed guard) or to the machinery when the guard is removed.

Guards which can be opened or removed to give access for adjustment or setting of controls or sensors whilst the pump is in operation shall be secured against unintended disturbance both when open and closed and shall not be required to be interlocked. A1

Unhindered access to the shaft seal where required for checking of its function and/or for its adjustment shall be permitted.

Machined or cut parts which are exposed or likely to be exposed at any stage during the installation, operation, or servicing of the pump or pump unit shall be treated to remove burrs, rags and sharp edges A1 *deleted text* A1 .

5.2.1.2 High pressure fluid ejection

5.2.1.2.1 Shaft, piston rod or plunger sealing system

The pump shall be equipped with a shaft-, piston rod- or plunger sealing system compatible with the pumped fluid and appropriate to the hazard likely to result from a leakage of that fluid. In assessing the compatibility attention shall be given concerning the nature of the liquid, the pressure, and temperature. Because of the range of characteristics of pumped liquids it is not possible to give any precise requirements to reduce the risks.

5.2.1.2.2 Pressure containing elements

Pressure containing parts and components of a pump are to be designed to be suitable for the maximum allowable working pressure. Movement resulting from the loss of pressure shall not create a hazard.

For reciprocating displacement pumps the maximum allowable working pressure is the highest value for the mean pressure in the outlet section of the pump.

In the case where the pump potentially can generate pressure in any part greater than the maximum allowable working pressure of that part, the supplier shall either provide a pressure relief valve or other device to prevent the pressure in the part exceeding 90 % of the hydrostatic test pressure (see 6.2.4), or shall advise the user of the need to make such a provision.

5.2.1.2.3 Permitted forces and moments on pipe connections

The permitted forces and moments on pump inlet and outlet branches are to be stated by the manufacturer/supplier. For rotodynamic pumps typical values for permissible forces and moments can be taken from **A1** EN ISO 5199; EN ISO 9908; EN ISO 9905 **A1**.

For rotary positive displacement pumps typical values for permissible forces and moments can be taken from **A1** EN ISO 14847 **A1**.

Other connections shall be capable of withstanding the forces and moments which may arise from normal operation and from foreseeable misuse.

5.2.1.3 Ejection of transmission parts

The upper and lower limits for torque, speed, and loads, for coupling, gears, links, etc. shall not be exceeded.

5.2.1.4 Loss of stability

The pump or pump unit shall remain stable in all phases of transport, assembly, dismantling in the conditions foreseen when tilted to an angle of 10° in any direction from its normal position. If the pump or pump unit does not meet this requirement the manufacturer/supplier shall define the supporting devices needed to achieve stability, or include specific reference to their need in the information for use/instruction for use. The supporting devices shall be treated as special tools (see 5.2.8.4), and details of their use shall be provided in the information for use/instruction for use.

When the pump is installed it shall be made stable by the use of holding down bolts or by the use of other anchoring methods. Holding-down bolts or other anchoring methods shall be strong enough to prevent unintended bodily movement of the equipment.

5.2.1.5 **A1** Lifting of pumps and pump units

Lifting machinery for pumps and pump units, lifting accessories and their components shall be capable of withstanding the stress to which they are subjected. Lifting machinery for pumps and pump units and lifting accessories shall be designed and constructed in such a way as to withstand the overload in static tests without permanent deformation. Strength calculations shall take into account the value of the static test coefficient of 1.5 to guarantee an adequate level of safety.

NOTE People responsible for pump or pump unit handling on site, in addition to the manufacturer's instructions, may refer to ISO 15513:2000, ISO 23813:2007, ISO 23853:2004 for the necessary skills, training and qualification of people dealing with handling devices. **A1**

5.2.2 Requirements to avoid electrical hazards

The electrical equipment of a pump unit shall satisfy the general requirements set out in **A1** EN 60204-1:2006 **A1**. Particular features shall conform to the particular clauses of **A1** EN 60204-12006 **A1** as indicated in this standard.

Electrical equipment shall be selected for safe operation in the intended application when used in the specified environment and working conditions, and on the declared characteristics and tolerances of the electrical supply taking into account predictable malfunctions (**A1** EN 60204-1:2006 **A1** clauses 4, 7, 8, 13, and 18).

The electrical supply on the pump unit shall be provided with means for its isolation from energy supply, or recommendations shall be included in the information for use/instruction for use. Such means shall allow for switching-off during normal operation and/or in an emergency (A1) EN 60204-1:2006 (A1) clauses 5, 18, and clause 5.2.8.3 of this standard).

Access to connections shall be restricted by devices e.g. shrouds or enclosures which shall be adequate to prevent the entry of predictable fluids or solids and will require tools for removal (A1) EN 60204-1:2006 (A1) clauses 4, 13, and 16).

The pump unit shall be protected by an earth terminal against the build up of positive charge. The earth terminal shall be connected directly to an earth conductor. (A1) *deleted text* (A1) Conductors shall be adequately sized for the maximum power load and insulated against the supply voltage and its tolerances, and be unambiguously identifiable by means of colour or other indicators (A1) EN 60204-1:2006 (A1) clauses 6, 7, 8, 14, 15 and 18).

Systems provided for the operational control of the pump unit shall be constructed from components and conductors meeting the requirements of this clause, and take into account the appropriate requirements and considerations set out in (A1) EN 60204-1:2006 (A1) clauses 9, 10, 12, 18, 19.

5.2.2.1 Electrical contact

(A1) Enclosures of electrical motors and control systems on the pump unit shall as a minimum give protection in accordance with EN 60034-5:2001 (motors) or EN 60529:1991 (control systems) IP 22. (A1)

5.2.2.2 Electrostatic phenomena

In order to prevent the build-up of electrostatic charge, an electrical potential balance for the related equipment is to be provided if necessary by the use of an earthing route. Care shall be taken to ensure that the electrical potential balance of the pump is not changed by lining, coating or similar treatment.

5.2.2.3 External effects on electrical equipment

Electrical enclosures and other protection arrangements together with their means of fitting shall be so constructed that no operating conditions occur which can lead to danger to personnel.

(A1) *deleted text* (A1)

5.2.2.4 (A1) Electromagnetic compatibility

Where applicable, the equipment shall conform to the requirements regarding electromagnetic compatibility. (A1)

5.2.3 Requirements to avoid thermal hazards

The pump or pump unit shall have reduced hazards to personnel arising from temperatures which result from the operation of the pump. This standard does not deal with means to reduce hazards from surface temperatures which derive from the temperature at which the pumped fluid is delivered to the pump inlet.

Steps shall be taken to minimise contact with or to warn operator/users of any surface which in normal operation will achieve a temperature exceeding those set out in Table 2.

Table 2 - Maximum permitted temperatures for unprotected accessible surfaces on the pump/pump unit during normal operation

	surfaces required to be touched in normal operation, or which may be touched unintentionally in a restricted zone¹⁾	surfaces which may be touched unintentionally in an unrestricted zone
metal ²⁾	68 °C	80 °C
ceramics	73 °C	84 °C
plastic	80 °C	90 °C
1) This table recognises that if a touched surface is in a position where withdrawal action may be delayed by restriction to movement (a restricted zone) the contact time may be extended unwillingly and a lower maximum temperature should be required. 2) Painted or unpainted		

The safety instructions required shall be set out in the information for use/instruction for use.

5.2.4 Requirements to avoid the danger of noise and vibrations

5.2.4.1 Requirements to avoid the danger of noise

This standard does not deal with the reduction of risks of hearing loss arising from prolonged exposure to noise from pumps and pump units. The pump manufacturer shall not take into account the effects of the installation in assessing the noise level.

5.2.4.2 Requirements to avoid the danger of vibrations

This standard does not deal with the reduction of risks arising from the prolonged exposure to vibrations generated by the pump or pump unit.

NOTE ISO 10816-7:2009 gives indicative levels of vibration for some specific types of pumps. **A1**

5.2.5 Requirements to avoid hazards from materials

The wide and varied nature of pump applications makes it not possible to specify precise combinations and grades of materials in a standard of common requirements. Materials shall be selected taking into account the chemical and mechanical characteristics of the liquid to be pumped and of the operating environment, its ability to safely withstand operating loads, its working life and the effect of fatigue, aging, abrasion, thermal, electrostatic and any other factor which it is expected may arise from the application and impact upon the materials.

Full attention shall be given to local regulations regarding materials suitable for particular purposes such as use with potable water, with foodstuffs, designated for fire protection reasons, etc.

Materials used shall not endanger the health and safety of personnel.

Materials used shall be appropriate with the liquid being pumped and identified in the specification, and with any lubricants, cooling/heating means, barrier or other fluids that may be introduced.

5.2.5.1 Disposal of liquid

A pump or pump unit operating on a flammable, toxic, corrosive or otherwise hazardous liquid, or on a liquid at a temperature of more than 60 °C shall be provided with a means such as a pipe connection, for use by the user, to collect for safe disposal any drained liquid or leakage from the shaft seal or discharge from a pressure relief valve.

Due to the varied nature of the liquid it is not possible to specify more precise means of disposal.

5.2.5.2 Disposal of gases

Pump units driven by an A1 internal combustion-engine A1 shall be provided with a means to collect exhaust gases for safe disposal. Advice on safe disposal of exhaust gases, and the provision of combustion air into the room of installation, shall be included in the information for use/instruction for use.

5.2.5.3 Fire and explosion hazards

A1 Pumps and pump units shall be designed and constructed in such a way as to avoid any risk of ignition of gases, liquids, dust, vapours or other substances within their intended use.

The requirements regarding potentially explosive atmospheres shall be applied as far as a risk of explosion occurs due to the use of the pump in a potentially explosive atmosphere. A1

5.2.6 Requirements to avoid hazards from neglecting ergonomic principles of machine design

Pump units incorporating signal displays and/or control actuators shall be designed in accordance with the principles set down in EN 894. Signals shall be arranged to be easy to read and unambiguous in meaning. Manual controls and other operating devices shall be easy to reach and operable without unreasonable effort. In particular, starting and stopping devices shall be clearly identified. Steps shall be taken including marking if necessary to avoid errors arising from confusion.

5.2.7 Requirements to avoid hazards caused by failure of energy supply, break-downs of machinery components and other malfunctions

5.2.7.1 Errors of fitting

Hazards arising from A1 incorrect assembly A1 of parts shall be eliminated by design.

If fasteners with special requirements are used, then interchangeable parts from other fasteners shall have the same quality.

5.2.7.2 Non-return device

If after switching off the pump unit, risks of hazards can occur through reverse flow in the pump, the manufacturer/supplier shall advise the necessity of a non-return device.

5.2.7.3 Direction of rotation of the pump

The direction of rotation of the pump shall be indicated in a distinctive place with a suitable arrow in a permanent form.

5.2.7.4 Auxiliary piping

Auxiliary piping necessary for the operation of the pump is to be set out in the information/instruction for use and/or arrangement drawing.

Where functions of connections may be confused leading to an unacceptable risk of hazard, connections shall be marked permanently on the pump.

5.2.7.5 Unexpected start-up

Ⓐ When this hazard exists the requirements of EN 1037 shall be fulfilled. Ⓐ

5.2.8 Requirements to avoid hazards through breakdown and/or wrong installation of protection devices

5.2.8.1 All types of guards

Ⓐ Guards which can be opened or removed shall be designed so that the reduction in risk will not be diminished by incorrect replacement.

Guards for the reduction of risks of hazards from contact with parts of a pump or pump unit shall be removable only with the use of a tool. Ⓐ

5.2.8.2 Measuring instruments and measuring instrument connections

If for reasons of operating security of the pump or pump unit monitor and/or alarm devices are necessary, the necessary connections for them shall be made available.

5.2.8.3 Emergency stop

If a dangerous situation arises which has to be stopped through manual intervention, then an Emergency Stop facility shall be provided conforming with the requirements of Ⓐ EN ISO 13850 Ⓐ, or instructions shall be provided for its provision.

If it can be shown that a normal cut-off device functions as an Emergency Stop with the same efficiency this is admissible and it shall be marked as such.

5.2.8.4 Special tools

If special tools are required to install, set up, or start the pump, or during its maintenance, they shall be fully specified and offered for supply by the manufacturer/supplier.

5.2.8.5 Safety devices (by-pass, control valve, pressure relief valve)

Safety devices which are adjustable shall be adjustable only by the use of tools or shall be contained in enclosures which can only be opened by the use of tools.

The manufacturer shall include warnings of the risks arising from adjusting such devices incorrectly.

6 Verification of the safety requirements and/or measures

6.1 General reference

Compliance with the safety requirements set out in clause 5 shall be verified by the use of one or more of the methods set out in 6.2. The appropriate method for a particular safety requirement can be found in clause 4, Table 1 in the column headed 'Verification'.

Ⓐ Verification shall be carried out considering the intended use and reasonable foreseeable misuse. Ⓐ Accessories and covers may or may not be fitted as long as the effect is not to obscure the validity of the test.

When dimensions, mass, or other factor make particular tests on complete equipment impractical, tests on sub-assemblies or components are permitted provided that it is verified that the result can be considered representative of the fully assembled equipment.

The verification in accordance with the safety requirements may be carried out in any sequence.

6.2 Specific methods of verification

6.2.1 Inspection

Verification shall be by appropriate physical examination and measurements of the pump or pump unit, of the specification defining it, and of the labelling and documentation describing it.

6.2.2 Review of documentation

The stated performance and features of the pump or pump unit shall be compared with those specified in the data sheet, standard, suppliers' data, or any other appropriate source to demonstrate compliance.

6.2.3 Calculations

Calculations used to establish compliance with a requirement shall be recorded by the manufacturer, be checked, and be retained for subsequent examination.

6.2.4 Hydrostatic pressure test for pressure containing parts

All pressure containing parts shall be hydrostatically pressure tested in accordance with **EN 12162**. The test pressure shall be related by a factor to the maximum allowed working pressure set out in the specification. In no case shall the factor be less than 1.3.

6.2.5 Noise measurement

The noise emission of the equipment shall be assessed by reference to measured values. These may be measured on the equipment concerned or from similar equipment operating under similar conditions. Noise emissions shall refer to the unit fully assembled with all auxiliary equipment, guards, and any noise control elements. The noise measurements shall be made in accordance with **EN ISO 20361**.

6.2.6 Guarding

Guards provided to prevent contact with surfaces or with moving parts shall be considered adequate if contact is not made when tested with the Test Fingers defined in EN 60529 with respect to penetration, rigidity, and impact.

6.2.7 Stability

The conformity can be demonstrated by test, or by calculation for equipment other than for portable units.

If a test is to be undertaken, the fully assembled pump shall be mounted on its usual base or feet and with all ancillary equipment fitted. If the unit is wheel-mounted, the wheels shall be positioned in the worst orientation for the test.

The base shall be tilted to up to 10° and no loss of stability shall be acceptable. Care should be taken during the test to ensure that in the event of instability no damage can occur to people or to property.

If calculations are to be the basis of conformity checking, they shall be based upon the centres of gravity method and shall not show any likely instability up to displacements of 12.5°.

6.2.8 Surface temperatures

Temperatures of touchable external surfaces are to be measured in accordance with the method defined in A1 EN ISO 13732-1 A1.

7 Information for use

7.1 General

The information for use shall correspond to the rules set out in A1 EN ISO 12100-2 A1.

7.2 Instruction for use - Instruction handbook

7.2.1 General

A1 The instruction for use/Instruction handbook shall correspond to the rules set out in EN ISO 12100-2.

The customer/purchaser shall receive the instruction handbook not later than when the pump or the pump unit is delivered by the manufacturer.

All the language versions provided shall bear:

- either “original instructions”, if it has been verified by the manufacturer;
- or “translation of the original instructions” if not.

At least one “original instructions” shall be included with the delivery.

In the case of partly completed machinery the customer/purchaser shall receive the assembly instructions included with the delivery. The assembly instructions shall be written in an official Community language acceptable to the manufacturer of the machinery in which the partly completed machinery will be assembled, or to his authorised representative. A1

7.2.2 Contents

The instruction handbook shall include safety information on the following subjects as far as they are relevant for the pump or pumping unit and any auxiliary equipment supplied and if they are necessary for reducing the risks during use :

- general ;
- A1 lifting A1 transport and intermediate storage ;
- description of the pump or pump unit ;
- installation/assembly ;
- commissioning startup, operation, shutdown ;
- maintenance and servicing ;
- faults ; cause and remedies ;

- A1 — dismantling, disassembling and disposal;
- mass of the pump or pump unit and sub-assembly or parts of repair where these are regularly to be transported separately; A1
- relevant documentation.

Additional information may be provided.

7.2.2.1 General

- A1 — A copy of the EC declaration of conformity (or a document setting out its content), not including the serial number and the signature; A1
- fields and limits of application or use, intended or permissible use, including any site conditions ;
- details of the pump/pump unit :
 - a) details which relate the operating manual to particular product ;
 - b) manufacturer, importer or supplier ;
 - c) designation, type, size ;
 - d) version No. and/or date of issue of instruction handbook ;
 - e) A1 noise emission:

NOTE 1 The requirements hereafter are not applicable when the equipment is concerned by the requirements regarding the noise emission outdoors.

- the A-weighted emission sound pressure level, where this exceeds 70 dB(A) at workstations;
- the peak C-weighted instantaneous sound pressure value, where this exceeds 63 Pa (130 dB in relation to 20 µPa) at workstations;
- the A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80 dB(A).

When these noise emission levels are required, the uncertainties surrounding these values shall be specified.

NOTE 2 Should the situation arise, then noise reducing measures should be agreed between purchaser and manufacturer/supplier. The instruction handbook should precise that hearing protecting devices may be used in case of long exposure to noise. A1

- f) Utility requirements e.g. electrical supplies, water supplies :
- warnings against foreseeable misuse.

The following signs are to be adopted into the instruction handbook :

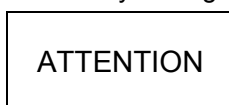
Safety instructions given in this manual non-compliance with which would affect safety are identified by the following symbol :




or where electrical safety is involved, with :




Safety instructions which shall be considered for reasons of safe operation of the pump or pump unit and/or protection of the pump or pump unit itself are marked by the sign :



7.2.2.2 Lifting, transport and intermediate storage

- preservative measures :
 - a) durability of protection ;
 - b) any subsequent preservation ;
 - c) removal of protection ;
- protection against environmental influences;
-  — instructions for safe lifting and movement.

NOTE People responsible for pump or pump unit handling on site, in addition to the manufacturer's instructions, may refer to ISO 15513:2000, ISO 23813:2007, ISO 23853:2004 for the necessary skills, training and qualification of people dealing with handling devices. 





7.2.2.3 Description of the pump or pump unit



- general description ;
- design and function ;
- design, function and use of safety protection devices ;
- additional descriptions for accessories ;
- dimensions, mass, centres of gravity, capacities.

7.2.2.4 Installation/assembly

- special assembly tools ;
- initial installation ;
- data on installation site :
 - a) space requirement for operation and maintenance ;
 - b) inspection before start of installation ;
 - c) details of base, foundation ;
 - d) installation of pump assembly ;
 - e) alignment requirements including flexible couplings ;
- assembly of driver and accessories ;
- correct installation of safety devices and control systems ;
- electrical connection, connecting cables ;
- grouting and other completion work ;
- pipework :
 - a) general ;
 - b) allowable forces and moments on inlet and outlet branches ;
- tightening torques for screw threads.

7.2.2.5 Commissioning startup, operation, shutdown

- documentation :
 - a) measuring point and piping diagrams (e.g. PI-diagram) ;
 - b) list of lubricants ;
- making the product ready for operation :
 - a) bearings ;
 - b) shaft seal ;
 - c) filling up/venting ;
 - d)  electric  connections ;
 - e)  check  of direction of rotation ;
- control and monitoring devices :
 - a) functional testing ;

- b) setting values ;
 - c) additional facilities (cooling, circulating, heating etc.) ;
 - d) motor protection (setting) ;
 - e) emergency switch ;
- safety devices :
 - a) mechanical (e.g. guards for coupling or belts) ;
 - b) sound insulation (e.g. protective hood) ;
 - c) splash protection (e.g. hood) ;
 - d)  relevant  electrical regulations ;
 - e) special devices ;
- commissioning :
 - a) initial commissioning ;
 - b) start after interruptions to the operation ;
 - c) pump-related requirements to the plant ;
 - d) activation/switching frequency ;
 - e) operation and start-up with close valve ;
 - f) special information (e.g. stand-by mode, faults) ;
- shutdown :
 - a) switching off ;
 - b) draining ;
 - c) preservation ;
 - d) storage ;
- other measures.

7.2.2.6 Maintenance and servicing

- maintenance and inspection :
 - a) consumable items including spare parts ;
 - b) monitoring during operation ;
 - c) any preventive action to be taken (e.g. regarding parts subject to wear, lubrication, sealing medium) ;
- disassembly and re-assembly :

- a) tools ;
- b) re-assembly procedure ;
- tightening torques for screw threads ;
- **A1** — specification of spare parts relevant to safety aspects. **A1**

7.2.2.7 Faults ; cause and remedies

- faults :
 - a) hydrodynamic ;
 - b) mechanical ;
 - c) electrical ;
- remedying of causes using product-related check list.

7.2.2.8 Relevant documentation

As agreed between manufacturer/supplier and customer/purchaser.

7.3 ■ **A1** Assembly instruction for partly completed machinery

For a partly completed pump a copy of the declaration of incorporation is required.

The assembly instructions for partly completed machinery shall contain a description of the conditions which shall be met with a view to correct incorporation in the final machinery, so as not to compromise safety and health. The assembly instructions shall be written in an official Community language acceptable to the manufacturer of the machinery in which the partly completed machinery will be assembled, or to his authorised representative. **A1**

8 Marking

The pump or pump unit shall carry the following minimum marking :

- **A1** — the CE marking;
- business name and full address of the manufacturer or authorised representative;
- designation of the machinery;
- designation of series or type; **A1**
- year of manufacture, serial number (if any) ;
- for pump units with electric motor, information about the electrical data e.g. :
 - a) voltage ;

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- b) frequency ;
- c) power rating.

Additional details may be provided for the pump as e.g. :

- rate of flow ;
- head ;
- speed of rotation.

Annex ZA (informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/CE

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive Machinery 98/37/EC, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.


WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. **A1**

Annex ZB (informative)


Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. 

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BSI Group
 Headquarters 389
 Chiswick High Road,
 London, W4 4AL, UK
 Tel +44 (0)20 8996 9001
 Fax +44 (0)20 8996 7001
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